# 1987 SUNFLOWER CROP IN BENSON AND RAMSEY COUNTIES, NORTH DAKOTA:YIELD, OIL CONTENT AND BLACKBIRD DAMAGE

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In 1979 and 1980 blackbirds (largely red-winged blackbirds, *Agelaius phoeniceus*; common grackles, *Quiscalus quiscula*; and yellow-headed blackbirds, *Xanthocephalus xanthocephalus*) damaged 0.8% and 2.0%, respectively, of the sunflower crop in Minnesota, North Dakota, and South Dakota (Hothem et al. 1988). At an average value of $0.10/lb (McMullen 1985), this represented a $5.6 million annual loss. In 1981 a sunflower damage survey was conducted in Benson County, North Dakota. The estimated loss due to birds was 2.4% of the crop (3,702,000 lb valued at $397,000) (Hothem et al. 1988). Sunflower losses in 1981 and 1984 in two different 144 mi² areas located in Sheridan and Wells counties, North Dakota, were 5.3% (496,000 lb valued at $49,000) (Sterner and Hothem 1982) and 2.4% (308,000 lb valued at $34,000), respectively (Linz et al. 1985). Thus, additional management strategies aimed at reducing the impact of blackbird feeding on sunflower are needed.

A multi-year study was initiated in 1986 to determine blackbird damage patterns to sunflower in a 308 mi2 area (Benson-Ramsey Block) in northeastern Benson and west-central Ramsey counties, North Dakota (Fig. 1). This survey, when conducted over a number of years, will provide estimates of sunflower production and blackbird damage to ripening sunflower fields over a range of growing conditions. These baseline data will also be used to evaluate management schemes implemented in the study area. We report data collected during the second year (1987) of this study and compare the results with those obtained in 1986 (Linz et al. 1987, Linz et al. 1988a). We thank J. Anderson, W. Bleier, K. Crane, B. Osborne, D. Thompson, and D. Twedt for assistance with the sunflower damage assessments. G. Mowery analyzed the sunflower for oil content. D. Otis provided assistance with the statistical analyses. M. Avery, M. Fall, and D. Otis commented on earlier drafts.

## Study Area and Methods

The study area was stratified into 4 quadrants (NE, SE, NW, SW) and 50 oilseed fields were randomly selected and surveyed for bird damage from 23-29 September. The number of fields surveyed in each quadrant was proportional to the total number of fields in the quadrant. Each field was divided into four strata of equal number of rows. One row was randomly selected from the first stratum. The remaining three rows were in the same relative position within the other three strata. Within those four rows, 24 5-ft linear plots were established by dividing the total length of the four rows by 24. The location of the first plot was a random distance in paces (approximately 1 yd/pace) between the field edge and the plot interval. The remaining 23 plots were located at uniform intervals. The diameter and undeveloped center of each head were measured with a steel tape by averaging two perpendicular measurements. A template was used to measure total area of damage (Dolbeer 1975). An average seed weight of 0.05 oz/in² was used for calculations. In addition to descriptive statistics summaries, 2-way analysis of variance was used to investigate the effects of year, quadrants, and their interaction on yield and arcsin-transformed percent of sunflower seeds damaged (Freund and Littell 1981). Oil content of sunflower grown in the study area was estimated by collecting seeds from 47 of the 50 fields surveyed. In 37 of these fields, two of the 5-ft plots surveyed for blackbird damage were randomly selected for seed sampling, in the other 10 fields about 50% of the plots were sampled for seeds. About 150 seeds were collected from the outer 1/3 of two randomly selected heads in each plot. These seeds were transported to North Dakota State University where they were dried to 10% moisture and oil content determined (±1%) using nuclear magnetic resonance analysis (Granlund and Zimmerman 1973).

In addition to descriptive statistic summaries, 1-way analysis of variance was used to determine if oil content of sunflower seeds varies significantly among fields (Freund and Littell 1981). The relationship between percentage of oil and bird damage, for all fields and for only within the 10 heavily sampled fields, was examined using the Pearson product-moment correlation.

The 50 sampled fields averaged 54 a (SE = 5) and had an estimated gross preharvest potential yield of 1581 lb/a (SE = 46) of sunflower seed. Average seed loss was 74 lb/a (SE = 16) or 4.3% (SE = 0.1). Seven (14%) of the fields received >10% damage and 14 (28%) received < 1% damage (Fig. 2). At $0.08/lb, estimated net yield and loss were valued at $126.48/a and $5.92/a, respectively. In the study area, growers lost an estimated 462,556 lb (441,472 - 483,640, 95% C.I.) of seeds, valued at $37,000 ($34,646-$39,328, 95% C.I.).

There was a significant difference among sunflower fields in percent of oil in the seeds (P= 0.0001). The 47 fields sampled averaged 46% oil (SE = 0.4, range 35% - 51%). Seventy percent of these fields averaged between 44% and 48% oil content (Fig. 3). There was no correlation between oil content and percent of damage among all oilseed fields (r = 0.08, P = 0.57, N = 47) nor within heavily sampled fields among all plots (r = 0.03, P = 0.68, N = 111).

We compared the results of this survey with those obtained in 1986 (Table 1). Yield per acre was significantly greater in 1987 (x = 1581, SE = 46) than in 1986 (x = 1354, SE = 64) (P = 0.01). There was no difference among the 4 quadrants (P = 0.67) nor was there a significant interaction between years and quadrants (P = 0.44).

Sunflower damage was 8.1% and 4.3% of the crop in 1986 and 1987, respectively (P = 0.07). In 1986, 27% of the fields received >10% damage and 7% incurred >30% damage (Fig. 2). In comparison, in 1987 14% of the fields received >10% and none received >30% damage. Percent of damage did not differ among quadrants (P = 0.58), nor was there a significant interaction between the main effects (P = 0.42).

## Discussion

In 1987 there were 17 more oilseed sunflower fields in the study area than in 1986. Due to additional acreage (900 a), increased yield (227 lb/a), and heavier seeds (10%), production was 1.5 million pounds greater in 1987 than in 1986. The North Dakota sunflower crop matured 7-10 days earlier than average and individual seeds contained 6% more protein and 1% more oil in 1987 than in 1986 (Schmidt 1988). Hence, as the birds migrated through North Dakota in 1987, they consumed more mature and heavier seeds than in 1986.

Unfortunately, we were unable to estimate the blackbird population in the study area in 1987. Thus, we have no data for assessing the relative change in bird numbers in the study area between 1986 and 1987. Both an earlier maturing crop and a reduction in bird numbers could account for some of the reduction in the percentage of seed lost in 1987. However, the differences in damage between years may be an artifact of crop rotation or some other unknown factor.

Although sampled fields varied significantly in percentage of oil, the birds showed no preference for sunflower fields based solely on oil content.

The lack of correlation between damage and oil content indicates that factors other than oil content, such as nearness to roosting habitat (Otis and Kilburn 1988), are important for birds when selecting sunflower fields and plants within fields.

From these limited data, we speculate that as sunflower production increases, the percentage of the crop that is damaged decreases. Additional studies in the Benson-Ramsey Block designed to establish the relationship among acres of sunflower planted (availability of a food resource), number of blackbirds, and amount of sunflower damaged are needed. These data are needed to evaluate methods of reducing sunflower losses to blackbirds.

## Literature Cited

1. Dolbeer, R.A. 1975. A comparison of two methods for estimating bird damage to sunflowers. J. Wildl. Manage. 39:802-806.

2. Freund, R.J. and R.C. Littell. 1981. Sas for linear models: a guide to the anova and glm procedures. SAS Institute Inc., Cary, North Carolina. 231 pp.

3. Granlund, M. and D.C. Zimmerman. 1973. Effect of drying conditions on oil content of sunflower (*Helianthus annuus* L.) seeds as determined by wide-line nuclear magnetic resonance (NMR). North Dakota Acad. Sci. 27:128-132.

4. Hothem, R.L., R.W. DeHaven, and S.D. Fairaizl. 1988. Bird damage to sunflower in North Dakota, South Dakota, and Minnesota, 1979-1981. U.S. Fish Wildl. Tech. Rep. 15. 11 pp.

5. Jaeger, M.M., J.L. Cummings, D.L. Otis, J.L. Guarino, and C.E. Knittle. 1983. Effect of Avitrol® baiting on bird damage to ripening sunflower within a 144-section block of North Dakota. Proc. Bird Control Seminar. Bowling Green, Ohio. 9:247-254.

6. Linz, G.M., M.D. Schwartz, J.L. Cummings, and J.L. Guarino. 1985. Multi-year damage assessments and block applications of 4-aminopyridine (Avitrol®) bait for reducing sunflower damage by blackbirds. Denver Wildl. Res. Ctr. Bird Damage Res. Rep. No. 341. 20 pp.

7. Linz, G.M., C.E. Knittle, and John L. Cummings. 1987. Multi-year assessments of blackbird damage to sunflower in a high damage area in Benson and Ramsey counties, North Dakota. Denver Wildl. Res. Ctr. Bird Damage Res. Rep. No. 383. 10 pp.

8. Linz, G.M., C.E. Knittle, and John L. Cummings. 1988a. Estimates of sunflower damage and size of blackbird population in a 308 mi² area in Benson and Ramsey counties, North Dakota. Proc. Sunflower Res. Workshop. Pp. 2-3.

9. Linz, G.M., D.F. Mott, and E.W. Schafer, Jr. 1988b. Progress on the development of an avian toxicant (CPT). Proc. Sunflower Res. Workshop. Pp. 3-4.

10. McMullen, M. P. (ed). 1985. Sunflower Production and Pest Management. North Dakota Ag. Exp. Sta. and North Dakota Coop. Ext. Service. North Dakota State University, Fargo, North Dakota. 76 pp.

11. Otis, D. L. and C. M. Kilburn. 1988. Influence of environmental factors on blackbird damage to sunflower. U.S. Fish Wildl. Serv. Tech. Rep. 16. 11 pp.

12. Schmidt, K. (ed). 1988. 1987 United States sunflower crop quality report. Natl. Sunflower Assoc., Bismarck, North Dakota. 20 pp.

13. Sterner, R.T. and R.L. Hothem. 1982. Analysis of blackbird damage to sunflower fields surrounding Sheyenne Lake, North Dakota –1981. Denver Wildl. Res. Ctr. Bird Damage Res. Rep. No. 299. 15 pp.
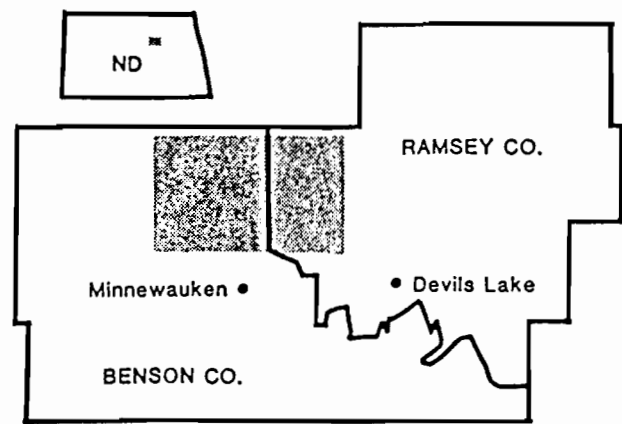
Figure 1. Study area in northeastern Benson and west-central Ramsey Counties, North Dakota.



Figure 2. Cumulative distribution of sunflower fields in the 308 mi² study area in northeastern Benson and west-central Ramsey Counties, North Dakota, in 1986 and 1987 across percent of loss of sunflower.

Table 1. Oilseed sunflower acreage and estimated bird damage to sunflower in a 308 mi² area located in northeastern Benson and west-central Ramsey Counties, North Dakota in 1986 and 1987.

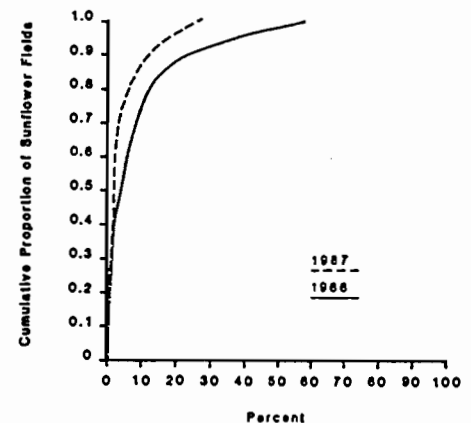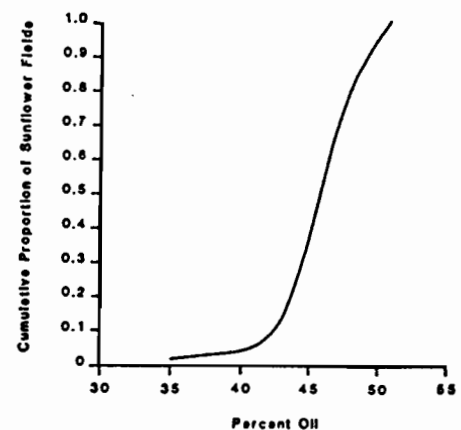| | 1986 | 1987 |
|---|---|---|
| Total fields | 109 | 126 |
| Estimated total acreage (a) | 5,995 | 6,804 |
| Number of sampled fields | 67 | 50 |
| Mean field size (a) | 55  (SE = 3) | 54  (SE = 5) |
| Average potential yield per acre (lb) | 1,354  (SE = 64) | 1,581  (SE = 46) |
| Average loss (lb/a) | 108  (SE = 17) | 74  (SE = 16) |
| Percent loss | 8.1% (SE = 0.8) | 4.3% (SE = 0.1) |
| Estimated total damage (lb) | 657,496 | 462,556 |
| (95% C.I.) | (530,217 - 784,774) | (441,472 - 483,640) |
| Loss (@ $0.08/lb) | $52,600 | $37,000 |
| (95% C.I.) | ($42,417 - $62,779) | ($34,646 - $39,328) |



Figure 3. Cumulative distribution of sunflower fields in the 308 mi² study area in northeastern Benson and west-central Ramsey Counties, North Dakota, in 1987 across percent of oil.